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Diet quality in persons with and without depressive and anxiety disorders

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ABSTRACT

Objective: This study examines the association of depressive and anxiety disorders and their clinical characteristics (disorder type, severity, chronicity and clinical subtypes) with diet quality.
Method: Data from 1634 adults (controls = 336, current disorder = 414, remitted = 886) were sourced from the 9-year follow-up of the Netherlands Study of Depression and Anxiety. Depressive and anxiety disorders were established with Composite International Diagnostic Interviews. Severity was measured with the Inventory of Depressive Symptomatology (IDS), Fear Questionnaire and the Beck Anxiety Inventory. Chronicity was measured with life-chart interviews expressed as percentage time with a disorder(s). Diet quality was evaluated using the Mediterranean Diet Score (MDS) and the Alternative Healthy Eating Index (AHEI).
Results: Diet quality was significantly worse among subjects with a current disorder than among healthy controls. Subdividing subjects showed that those with concurrent depressive and anxiety disorders had the lowest diet quality score (MDS: β = −0.41 per SD, 95% Confidence interval (95%CI) = -0.60, −0.21; AHEI β = −0.22 per SD 95% CI = −0.42,-0.03). More chronic depression or anxiety disorders and increased severity in all participants showed a dose-response association with poorer diet quality. There was no distinct pattern between IDS items related to depression subtypes and diet quality.
Conclusion: Diet quality is poorer in persons with depressive and anxiety disorders; in particular in those with comorbidity. The more severe and chronic the symptoms, the poorer the diet quality. Prospective studies are needed to confirm the direction of the relationship of depressive and anxiety disorders with diet quality and to examine whether improving diet quality could improve mental health.

1. Introduction

Depression represents one of the main contributors to the burden of disease (Ferrari et al., 2013) with around 6% of the world population having a major depressive disorder (MDD) at any one time (Alonso et al., 2004). Additionally, depression is often recurrent or chronic, and has a negative impact on people's functioning and somatic health (Penninx et al., 2013) thus making it an important public health concern. Furthermore, depression is frequently comorbid with anxiety disorders (Melartin et al., 2002) which are the sixth leading cause of years lived with disability (Baxter et al., 2014). Depression has been associated with poor nutrition, possibly explaining its association with increased somatic morbidity. Cross-sectional studies have associated increased depression severity with higher caloric intake from saturated fat and sugars (Whitaker et al., 2014) and higher sweet food consumption (Jeffery et al., 2009) and clinical depression with reduced antioxidant, fruit and vegetable intake (Payne et al., 2012). However, analysing the overall diet, as opposed to individual food groups, has the benefit of reflecting how foods are consumed in relation to each other.

For some people, stress and stressful situations, which can lead to depression, precipitates less healthy food choices (Gibson, 2006; Laitinen et al., 2002). A change in appetite is one of the key symptoms of depression according to the Diagnostic and Statistical Manual of Mental Disorders V (DSM V) (American Psychiatric Association (APA), 2013). Other depressive symptoms, such as reduced energy and a lack of interest in activities, may influence diet quality through a lack of energy/motivation to prepare or enjoy meals. Thus it is conceivable that depressive disorder may affect dietary choices. However, the association between depression and diet quality is complex and is likely bidirectional given that many studies show that healthier diets are associated with a lower risk for developing depression (Molendijk et al., 2018). Anxiety disorders can also affect dietary intake. In addition to symptoms experienced during panic attacks which are generally short lived and include symptoms such as nausea, abdominal discomfort and

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a dry mouth, people suffering from anxiety are generally restless, tire quickly and may also suffer from physical symptoms such as stomach aches and indigestion (American Psychiatric Association (APA), 2013), all of which could affect appetite or enthusiasm for food preparation. Thus we would expect both anxiety and depression to similarly reduce the quality of diet.

Previous studies are limited because symptom questionnaires rather than clinical diagnosis have been used to ascertain depression, and comorbidity with anxiety is mostly ignored. Furthermore, diversity in severity, chronicity and symptom profiles has been largely ignored. For example, based on distinct clinical symptom profiles, the current DSM identifies two frequently occurring subtypes of depression: melancholic and atypical. As melancholic and atypical depression differ, amongst others, in neurovegetative symptoms and have opposite appetite scoring, these differing clinical features could differ in their relationship with diet quality. Thus the heterogeneity of depression should be taken into consideration. Given that two recent randomised control trials have demonstrated that a healthy diet can potentially reduce depressive symptoms (Jacka et al., 2017; Parletta et al., 2017), insight into the characteristics and subtypes of mental disorders that are related to a poorer diet, may help us to target future intervention studies and treatment programmes.

This study, therefore, examines the relationship between clinically diagnosed depressed and anxiety disorders with diet quality. Specifically, we examined whether there is a relationship between having depressive and/or anxiety disorders and diet quality. We then examined the following specific clinical characteristics (1) disorder type (depressive disorder, anxiety disorder and their comorbidity), (2) chronicity, and (3) disorder severity. Finally, we explore the individual clinical symptoms encompassing atypical and melancholic features of depressive disorder.

2. Methods

2.1. Source population

The data was sourced from the Netherlands Study of Depression and Anxiety (NESDA), an ongoing, longitudinal cohort study. The baseline sample consists of 2981 patients 78% with a lifetime depressive or anxiety disorder, aged 18–65 years. Patients were recruited in three different Dutch regions from the general population, in general practice and in mental health organisations.

Baseline interviews collected data on a wide range of variables including psychiatric diagnoses. Mental health status was assessed again during interviews at two, four, six and nine years. During the 9-year assessment all participants (n = 2069) were asked to complete a food frequency questionnaire (FFQ). Written informed consent was obtained. The research protocol was approved by the Ethical Committee of the participating university. Further details of NESDA can be found elsewhere (Penninx et al., 2008).

2.2. Study population

We included participants from the 9-year follow-up assessment with complete FFQ data (n = 1671). Of these, 37 participants were excluded due to improbable energy intake (females: < 500 kcal, > 3500 kcal, males: < 800 kcal, > 4000 kcal) (Willett, 2013) leaving a total sample of 1634. Those who did not complete the FFQ were more likely to be male, younger, less educated and have a higher severity of depression (measured with the Inventory of Depressive Symptomatology), but not anxiety.

2.3. Depressive and anxiety disorder status and clinical characteristics

At each assessment the presence of a DSM-IV depressive (MDD, dysthymia) or anxiety disorder (social phobia, agoraphobia, general anxiety disorder and panic disorder) was established using the Composite International Diagnostic Interview (CIDI) version 2.1 (Wittchen, 1994). At the 9-year follow-up assessment participants were classified into disorder status: controls (no lifetime history of depressive/anxiety disorder), current disorder (6-month recency of depressive/anxiety disorders), or remitted disorder (lifetime diagnosis of depressive/anxiety disorder).

2.3.1. Disorder type

In addition to general disorder status, disorder subcategories were constructed: control, remitted disorder, pure (current) depressive disorder, pure anxiety disorder or comorbid anxiety and depression.

2.3.2. Chronicity

At each follow-up interview the life-chart interview (Lyketsos et al., 1994) was used to assess months in which anxiety or depressive symptoms were present since the last interview for those with a clinical diagnosis during that period. The sum of months was then expressed as a percentage of time with symptoms over the total 9-year period.

2.3.3. Severity of symptoms

We used the 30-item Inventory of Depressive Symptomatology - Self Report (IDS, range 0–84) (Rush et al., 1996). Severity of anxiety symptoms was measured using the 21-item Beck Anxiety Inventory (BAI, range 0–63) (Beck et al., 1988) and severity of fear with the 15-item Fear Questionnaire (score range 0–120) (Marks and Mathews, 1979).

2.3.4. Depressive symptom profile

Exploration of IDS items was done to investigate differences between depressive symptoms. Items were recoded into dichotomous variables, with a score of 0 or 1 indicating absence of symptoms, and a score of 2 or 3 indicating presence of the symptom (Khan et al., 2006; Schaakxs et al., 2017). The items for weight loss/weight gain and increased/decreased appetite were each recoded into two dichotomous category variables, one for each direction of change. Further details can be found elsewhere (Schaakxs et al., 2017). Items considered to be related to melancholic depression were (i) diminished reactivity of mood (ii) loss of capacity for pleasure, (iii) distinct quality of mood (i.e. different from sadness that is felt as if someone died), (iv) mood worse in the morning, (v) early morning wakening, (vi) feeling slowed down (vii) feeling restless, (vii) weight loss (viii) loss of appetite (Khan et al., 2006). Items associated with atypical depression were (i) reactivity of mood (not shown in results as this is the inverse of diminished reactivity of mood) (ii) weight gain (iii) increased appetite, (iv) hypersomnia, (v) leaden paralysis and (vi) interpersonal rejection sensitivity (Novick et al., 2005).

2.4. Dietary assessment

Dietary intake was assessed with a 238-item, semi-quantitative FFQ which was based on a validated ethnic Dutch FFQ (Siebelink et al., 2011). Frequency, amount and type of food eaten in the past month was assessed. Daily intakes (g/day) of food items were calculated using the Dutch Food Composition Table 2014 (Centre, 2011). Population medians were imported for missing amounts. Likewise, missing product sort (e.g. full-fat milk, semi-skimmed milk or skimmed milk) was replaced with distributions reflecting the population median. The total number of missing items was 1929 (0.58%) The FFQ also included the option to add additional food items consumed within the last week that were not included in the questionnaire. These items were manually re-categorised to comparable food items where possible. Each manual adjustment was made by consensus of two nutritional scientists.

Diet quality was assessed with two commonly used dietary indices: the Mediterranean diet score (MDS) (Panagiotakos et al., 2009) and Alternative Healthy eating index (AHEI) 2010 (Chiuve et al., 2012). The

Table 1
Descriptive characteristics of NESDA participants at the 9 year follow-up (N = 1634).

Variables	Controls	Remitted disorder	Current disorder	Total Population
	n = 334	n = 886	n = 414	n = 1634
Age (mean, sd)	51.0 (14.6)	52.4 (13.1)	52.6 (12.0)	52.0 (13.2)
Female (n, %)	199 (59.6)	613 (69.2)	296 (71.5)	1108 (67.8)
Education (years), (mean, sd)	13.9 (3.2)	13.0 (3.2)	12.8 (3.4)	13.1 (3.3)
Marital status				
Single	106 (31.7)	271 (30.6)	140 (33.8)	517 (31.6)
Married	188 (56.3)	443 (50.0)	189 (45.7)	820 (50.2)
Divorced/separated/widowed	40 (12.0)	172 (19.4)	85 (20.5)	297 (18.2)
Smoking status (n, %)				
Never	155 (46.4)	255 (28.8)	140 (33.8)	550 (33.7)
Current	47 (14.1)	225 (25.4)	108 (26.1)	380 (23.3)
Former	132 (39.5)	406 (45.8)	166 (40.1)	704 (43.1)
Physical Activity 1000 MET mins/week/(mean, sd)	3.7 (3.0)	4.0 (3.3)	3.4 (3.1)	3.8 (3.2)
Energy intake (kcal) (mean, sd)	2146 (571)	2132 (606)	2167 (622)	2144 (603)
BMI	25.9 (4.8)	26.3 (4.7)	26.5 (5.00)	26.3 (4.8)
Disorder Type (n, %)				
Current depressive disorder (w/o anxiety)	–	–	118 (28.5)	–
Current anxiety disorders (w/o depression)	–	–	178 (43.0)	–
Current comorbidity	–	–	118 (28.5)	–
Chronicity (Percent of time with depression/anxiety in previous 9 years) (median, IQR)	0.0 (0.0)	7.5 (0.0–30.0)	63.9 (39.2–88.0)	9.7 (0.0–45.7)
IDS score (median, IQR)	5 (2–9)	11 (6–17)	24 (15–32)	11 (6–21)
BAI Score (median, IQR)	1 (0–3)	4 (2–9)	13 (6–20)	5 (1–11)
Fear Score (median, IQR)	3 (0–10)	9 (3–19)	24 (12–40)	10 (3–22)
Mediterranean diet score (mean, sd)	33.3 (4.6)	32.9 (4.9)	31.8 (5.2)	32.7 (4.9)
Alternative healthy eating score (mean, sd)	58.8 (10.3)	59.2 (10.3)	57.2 (10.6)	58.6 (11.2)

BMI = body mass index IQR = inter quartile range, sd = Standard deviation, IDS= Inventory of Depressive Symptomatology, BAI= Beck Anxiety Inventory, w/o = without, % = % of disorder status group.

MDS comprises 11 food components with a total score range 0–55 and the AHEI has 11 food components, although as our FFQ did not assess salt intake this component was excluded, leaving an overall score ranging from 0 to 100. The MDS was chosen because it is an established score based on a southern European diet that has shown to be associated with depression (Psaltopoulou et al., 2013) and has also been associated with lower mortality (Sofi, 2009) and other somatic diseases (Gotsis et al., 2015). Conversely, the AHEI is based on United States Department of Agriculture's Healthy Eating Index and has shown to be associated with chronic disease (McCullough et al., 2002) as well as with inflammatory markers (Fung et al., 2005) which have been linked to depression. As the two scores differ in their origins and content, e.g. the AHEI has a larger focus on type of fat consumed, it was interesting to compare the two.

2.5. Other variables

The a-priori selected covariates were: gender, age, years of education, marital status (married, single/divorced/separated/widowed), smoking status (current, never/former), physical activity and energy intake measured at the 9 year follow-up. Physical activity during the past week was measured with the International Physical Activity Questionnaire (IPAQ) (Ekelund et al., 2006; Kurtze et al., 2008) and converted to metabolic equivalent total (MET) minutes per week by using the following formula: MET level * minutes of activity * events per week (Craig et al., 2003). All analyses were adjusted for overall energy intake (kcal/day), derived from the FFQ, to isolate the effect of increased consumption resulting from different body size, nutritional requirements, and physical activity levels.

The antidepressants Tricyclic antidepressants (TCA's) and Mirtazapine are known to influence appetite (Fava, 2000), thus a sensitivity analysis was performed excluding users of these antidepressants. Antidepressant used in the previous month were asked during interview and classified according to the Anatomical Therapeutic Chemical (ATC) classification. Use of antidepressants was considered when taken at least 50% of the time.

2.6. Statistical analysis

The analyses were conducted using SPSS 22 (IBM Corp., Armonk, NY, USA). Statistical significance was set at $p < 0.05$. Descriptive characteristics were calculated using the frequency, mean (median for non-normally distributed variable) and distribution of all variables according to disorder status. As there was little difference between a model adjusted for socio-demographic only and a fully adjusted model (adjusted for age, gender, education (years), marital status, smoking status, physical activity and energy intake), we report on fully adjusted analyses. Analyses of covariance (ANCOVA) were used to determine differences across disorder status groups, using post-hoc Bonferroni corrections to analyse differences between groups.

Associations between disorder type, chronicity and severity with AHEI and MDS, adjusted for covariates, were estimated using linear regression analyses. The three severity scores and the two diet scores were standardised enabling comparison of regression coefficients. A sensitivity analysis was performed excluding persons taking TCAs and Mirtazapine. In order to establish which clinical characteristic is the driving factor behind the relationship between depression/anxiety and diet quality, a post-hoc analysis was performed entering disorder type, chronicity and severity into one model.

Linear regression analysis was used to estimate the association between each specific depressive symptoms (i.e. IDS items) and diet quality with the aim of identifying potential patterns between items associated with melancholic or atypical depression. Multiple testing was corrected for with the modified FDR (B-Y) method (Narum, 2006). All analysis were adjusted for the prespecified covariates.

3. Results

Of the 1634 participants, 334 never had depressive or anxiety disorder (controls), 886 had a history of anxiety or depression (remitted) and 414 had a current disorder. The mean age was 52 years, mean energy intake was 2244 kcals and mean diet quality scores were 32.7 (MDS) and 58.6 (AHEI). Controls had a higher (healthier) diet score compared to those having a current disorder (33.3 vs 31.8 for MDS and

Table 2
Adjusted[1] means[2] for the diet quality scores by disorder status (N = 1634).

	Mediterranean Diet Score	Alternative Healthy Eating Index
	Mean (SD)	Mean (SD)
Control	32.6 (11.0)	57.6 (23.1)
Remitted depression/ anxiety	32.5 (7.1)	58.6 (14.9)
Current depression/ anxiety	31.6 (9.8)[a,b]	56.8 (20.7)[b]

a = Significantly different from control group (post hoc, Bonferroni correction $p < 0.01$) Cohen's d = 0.11.
b = Significantly different from remitted group (post hoc, Bonferroni correction p = 0.01) Cohen's d = 0.10 (MDS) 0.09 (AHEI).
[1]All analyses adjusted for age, gender, education (years), marital status, smoking status, physical activity and energy intake.
[2]Adjusted means and standard deviations were obtained and group differences were tested using analysis of covariance (ANCOVA).

58.8 vs 57.2 for AHEI) (Table 1). The variation in diet quality was normally distributed and the Pearson correlation between MDS and AHEI scores was 0.62.

ANCOVAs indicated that having a current disorder was significantly associated with poorer quality diet according to the MDS, compared to being remitted or control after adjustment (Cohen's d = 0.11 $p < 0.01$ and d = 0.10, p = 0.01, respectively). Persons with a current disorder had a significantly lower AHEI score compared to persons with a remitted disorder (Cohen's d = 0.09, p = 0.01), but did not significantly differ from controls (Table 2).

When examining the role of disorder type, linear regression analysis showed that persons having comorbid depressive and anxiety disorders had significantly lower diet quality scores compared to healthy controls (MDS: β = −0.41, 95% Confidence interval (95%CI) = −0.60, −0.21; AHEI: β = −0.22 95% CI = −0.42,-0.03) (Fig. 1 and supplementary table 1). Increasing chronicity was related to a lower MDS score, but not AHEI, in a dose response manner. All three severity scores were negatively associated with diet quality (supplementary table 1). Combining all characteristics into one model showed that disorder severity remains significantly related to the diet scores.

Excluding participants taking TCA's or Mirtazapine (n = 69) did not alter the association between disorder type and severity with diet quality, although the association with chronicity was reduced and no longer significant (data not shown). Exploration of the relationship between individual depressive symptoms (IDS items) and diet quality revealed no clear systematic distinction between atypical and melancholic symptoms (Fig. 2). After correction for multiple testing, 15 items were significantly related to the MDS and four to the AHEI. The symptoms “sleeping too much” and “decrease in appetite” had the strongest association with poorer diet quality after correction for covariates.

4. Discussion

This study is the first to examine the clinical characteristics of depressive and anxiety disorders and their associations with diet quality using a large cohort of participants with and without depression and anxiety disorders. Participants suffering from a current disorder were more likely to consume a less healthy diet (as measured by the MDS) compared participants with a remitted disorder or healthy controls. The AHEI gave a less clear picture with having a current disorder differing only from having a remitted disorder. Further analyses into disorder type revealed that persons with comorbid depression and anxiety had a significantly poorer diet quality according to both diet scores. Depression or anxiety disorder alone were not significantly related to diet quality. In consonance with this, both the chronicity and the severity of the disorder were associated with lower diet quality. The relationship between depression and diet quality did not seem to be subtype specific and we found no evidence that melancholic or atypical symptoms were particularly associated with either a better or poorer quality of the diet. In general, the association between clinical characteristics and diet quality was stronger when measured using the MDS as opposed to the AHEI.

Only two previous studies have compared diet quality in participants with a clinical diagnosis of depression to controls (Beydoun and Wang, 2010; Rahe et al., 2015). Both studies found no association between major depressive disorder and diet quality as measured by the Healthy Eating Index (n = 2217) and a score based on German nutritional recommendations (n = 1660). We found participants with a current disorder differed from controls only when using the MDS but not the AHEI. Both scores, however, revealed that those with a remitted disorder had significantly better quality of diet compared to those with a current disorder, and indeed in the case of the AHEI, remitted persons have a better quality of diet than controls. This suggests that a history of depression/anxiety disorder stimulates better dietary intake and an improvement in diet. This is in-line with the conclusion of Jacka et al., who suggests that while current depression is associated with poorer dietary habits, a history of depression may prompt healthier dietary behaviours in the long term (Jacka et al., 2015). Subdivision into disorder type revealed that having comorbid depression and anxiety is

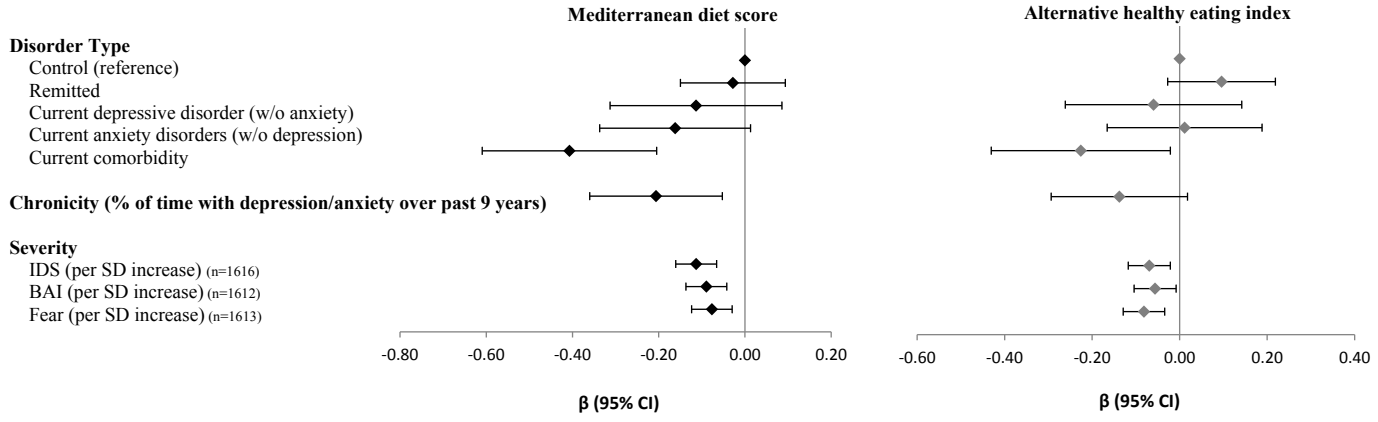

Fig. 1. The association between characteristics of anxiety and depression (disorder type, chronicity and severity) with standardised Mediterranean diet score and the Alternative healthy eating index (N = 1634).
IDS= Inventory of Depressive Symptomatology BAI= Beck Anxiety Inventory.
All analyses were Adjusted for age, sex, education (years), marital status, smoking status, physical activity, energy intake.

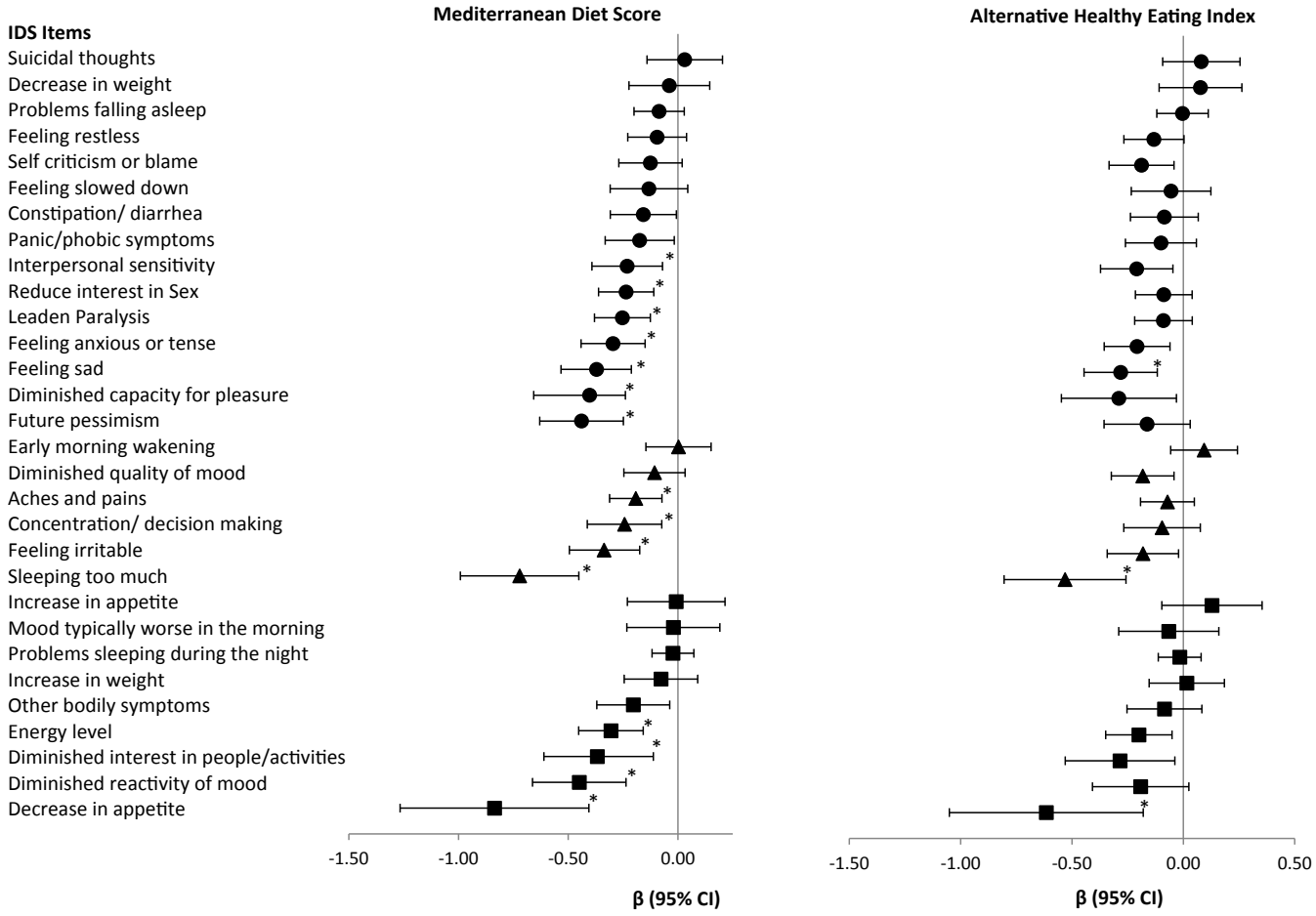

Fig. 2. Multiple linear regression analyses with depressive symptoms as predictor and diet scores as outcome variable (N = 1634).
All analyses are adjusted for age, sex, education (years), marital status, smoking status, physical activity, energy intake and severity of depression.
*significant after correction for multiple testing. ■ = Melancholic▲ = Atypical● = Other symptom.

significantly related to poorer diet quality based on both scores. Notably, persons with comorbid depression and anxiety tend to have more severe symptoms (Median IDS = 33.5, BAI = 18, FEAR = 36) compared to those only suffering from either depression or anxiety disorder. Post hoc analysis, where all characteristics were entered simultaneously into one model, showed only the severity of anxiety/depressive disorder remains significantly related to diet quality, implying that severity is the driving factor relating anxiety and depression to diet quality.

We found a clear association between depression and anxiety severity and diet quality. Prior cross-sectional studies are not wholly consistent. The majority of studies are in accordance with our findings (Appelhans et al., 2012; Beydoun et al., 2009; Jacka et al., 2010; Pagoto et al., 2009; Quirk et al., 2013; Rienks et al., 2013; Saneei et al., 2016; Sinclair et al., 2016), however, one study did not find an association when using the AHEI in a population of obese/overweigh African American women (Whitaker et al., 2014). A second study only found an association in distinct clinical subtypes based on a German guideline based diet score. Differences between studies could be attributed to the use of different diet scores and sample selection.

Examining the IDS items individually showed that decrease in appetite and sleeping too much had the strongest associations with poor diet quality. There was no difference in items affiliated with melancholic depression compared to atypical depression and their association with diet quality. In another study, Rahe et al. observed that patients with melancholic depression had significantly higher diet quality scores compared to controls using a German diet quality score in a German population (Rahe et al., 2015). Patients with undifferentiated, atypical, and mixed depression had lower diet quality scores than controls, although these differences were not statistically significant (Rahe et al., 2015).

Overall, stronger associations of current disorders were found with the MDS than the AHEI, whilst the AHEI detected differences between those with a remitted disorder versus a current disorder. Both scores include intakes of fruit, vegetable, whole grains, legumes, red meats and alcohol. However the MDS score also includes potatoes, fish, poultry, olive oil and high fat dairy products whereas the AHEI includes sugar sweetened beverages, nuts, trans fats, eicosapentaenoic acid (EPH) and docosahexaenoic acid (DHA) and polyunsaturated fatty acids. This would suggests that some elements of the Mediterranean diet are maybe driving the link between depression and diet quality, such as fish, which apart from EPA and DHA also comprises high quality protein and vitamins and minerals or that an element within the AHEI, such as the EPA/DHA ratio, mitigates the link between depression and diet quality. Indeed some studies have found that fish intake and olive oil are associated with lower risk of depression (Li et al., 2016; Sánchez-Villegas et al., 2011). On the other hand a few studies have shown that sugars and sugar sweetened beverages, both components of the AHEI, are associated with depressive symptoms, which would suggest that the AHEI has similar strength associations with depression and anxiety as MDS (Guo et al., 2014; Knüppel et al., 2017). Other aspects of the scores which may explain the different associations with depression/anxiety disorders is the different weightings between food groups. For example, the AHEI focuses more on fat consumption

with three items about fat ratios compared to the MDS which asked about full fat dairy and fish intake.

Possible mechanisms linking depression to poorer diet quality is through emotional eating which, due to the inability to distinguish hunger from other bodily arousal (e.g. emotions), leads to increased food consumption, particularly energy-dense sweet/high fat foods, thereby excluding healthier choices (Bruch, 1961; Konttinen et al., 2010). Several studies, including one on NESDA, have confirmed the association between emotional eating with depressive symptoms (Konttinen et al., 2010; Paans et al., 2018; Whitaker et al., 2014). Alternatively, depression could influence food choices through the hypothalamus-pituitary-adrenal axis (HPA-axis), which is hyperactive in people with depression (Penninx et al., 2013). Elevated activity of the HPA-axis is paired with an increase in serum glucocorticoids which stimulate an increase in appetite with a preference for energy rich foods (Tasker, 2006), probably at the expense of healthier food. Another mechanism could be though body mass index (BMI) as an unhealthy diets tend to lead to higher BMI which itself has been associated with an increased risk of depression. Finally, healthy diets typically require more time and cooking skills, whereas unhealthy foods are quick and easy to prepare. Energy levels and motivation are typically lower in depressed persons. This pathway is supported by our finding that the "energy level" and "diminished interest in people/activities" items from the IDS were significantly associated to poorer diet.

Strengths of this study are that it is the first to analyse anxiety and depressive disorders together and as separate entities, its use of a clinical diagnosis of depressive/anxiety disorder and the inclusion of a range of clinical characteristics. There are, however, some limitations. Firstly, as a cross-sectional study we cannot determine the direction of association. Many prospective studies that have found that poor diet quality is associated with the development of depression (Molendijk et al., 2018; Rahe et al., 2014) and two randomised control trials have found Mediterranean-like diets can reduce depressive symptoms (Jacka et al., 2017; Parletta et al., 2017). The possibility of a bidirectional relationship can therefore not be eliminated. Secondly, as with all observational studies, there is the possibility of residual confounding. Thirdly, assessing dietary intake with a FFQ is prone to misreporting. Over and underestimation of actual food consumption, poor recall and the omission of frequently eaten items from the FFQ are inherent problems. However, we removed those with extreme energy intakes, and added other self-report frequently consumed products which partially resolved these issues. Fourthly, possibly, reporting accuracy in the FFQ is associated with disorder severity as depression can influence cognitive function. Furthermore, non-completion of the FFQ was associated with severity of depression. Finally, similar score on MDS/AHEI does not imply similar food consumption, thus we can only surmise about the overall diet and not about individual food groups.

In conclusion, this study suggests that persons with a current disorder, especially comorbid depression and anxiety, are more likely to eat an unhealthy diet compared to controls. Increased symptom severity and chronicity were also associated with a less healthy diet. There appeared to be no difference between the melancholic and atypical depressive subtypes in their association with diet quality. The relationships were slightly stronger when diet quality was operationalized with the MDS compared to the AHEI. Prospective studies are needed to confirm the temporal relationship between depressive and anxiety disorders and diet quality. Given the consistent relationship between poor diet and depressive and anxiety disorders, clinicians should advocate dietary improvement inpatients in order to preserve mental health.

Declarations of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2018.09.006.

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